

"EXPRESS MAIL" MAILING LABEL
NUMBER EL 702049337US
DATE OF DEPOSIT May 9, 2001
I HEREBY CERTIFY THAT THIS PAPER OR FEE IS BEING
DEPOSITED WITH THE UNITED STATES POSTAL SERVICE
"EXPRESS MAIL POST OFFICE TO ADDRESSEE" SERVICE
UNDER 37 C.F.R. 1.10 ON THE DATE INDICATED ABOVE
AND IS ADDRESSED TO THE COMMISSIONER OF PATENTS
AND TRADEMARKS, WASHINGTON, D. C. 20231
K.A. HANSEN
(TYPED NAME OF PERSON MAILING PAPER OR FEE)
K.A. Hansen
(SIGNATURE OF PERSON MAILING PAPER OR FEE)

Apparatus for Handling Sheet Metal Workpieces to be Welded

BACKGROUND OF THE INVENTION

1. Technical Field

[0001] The present invention relates to methods and apparatus for welding metal sheets in general, and to methods and apparatus for controlling the gap between the metal sheets being welded in particular.

2. Background Information.

[0002] Laser welding is now in widespread use as a process for joining metal sheets together. In this process the sheets are preferably butt jointed, with their edges positioned so that there is only a narrow gap between the sheets. To obtain a weld seam of high quality, the gap between the sheets to be joined should not be wider than 0.05 or 0.08 mm, and the deviations of each individual sheet should not exceed one half of these maximum permissible widths of gap. It is obvious that in order to observe such tolerances, correspondingly expensive tools, or complicated machining methods, are necessary.

[0003] It is known from European Patent Application No. EP 0565846 when welding straight seams to plastically deform at least one of the metal sheets with a squeeze roller before or in the welding zone so that the maximum permissible width of gap between the sheets to be joined is not exceeded. In connection with this known teaching, a series of embodiments

0565846-050001

[0004] The known teaching is only suitable for straight weld seams. In particular it is unsuitable if there is a requirement to guide the weld seams along a given line, as in such cases the squeeze rollers proposed in the known teaching generate lateral forces which can lead to undesired distortions of the metal sheets.

[0005] It is, therefore, an object of the present invention to provide a method and an apparatus for welding metal sheets that can weld a seam along any given line.

[0007] The invention has the following advantages: Since a squeeze roller is used which obtains a plastic deformation that is independent of the squeeze roller's direction of advance on the metal sheet concerned, the weld

[0007] The invention has the following advantages: Since a squeeze roller is used which obtains a plastic deformation that is independent of the squeeze roller's direction of advance on the metal sheet concerned, the weld

seam can be guided along any given line without risking insufficient deformation of the sheets to be welded. The method according to the invention and the apparatus for carrying out the method can therefore be used for welding sheets of any desired shape.

[0008] When, in a continuation of the invention, the squeeze roller consists of a ball, it moreover becomes possible to obtain an apparatus according to the invention that is extremely compact, as the radius of the ball is greatly reduced in comparison with the outer dimensions of the known squeeze rollers, which means that the force acting on the squeezer ball to yield a given effect can also be reduced.

[0009] Lastly, by forming the squeeze roller according to the invention as a ball, it is possible to set the mounting (or "support") of the squeeze roller at an oblique angle to the plane formed by the sheets to be welded. This leaves the joint line between the sheets freely accessible, so that detection devices can be used to detect the actual width of gap between the sheets in the squeezing zone. The force acting on the squeezer ball can then be adjusted in response to the instantaneous value of the width of the gap.

[0010] These and other objects, features, and advantages of the present invention will become apparent in light of the Detailed Description of the Invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] A detailed description of the invention will now be given by way of example and with reference to drawings, in which

[0012] Fig. 1 shows a section through an arrangement according to the invention, made in the region of the welding zone, perpendicularly to two metal sheets of unequal thickness which are to be welded together;

[0013] Fig. 2 shows a section through a further embodiment of the invention, made perpendicularly to two metal sheets of equal thickness which are to be welded together;

[0014] Fig. 3 shows a similar section to Fig. 2 through a further embodiment of the invention; and

00031403 000001

DETAILED DESCRIPTION OF THE INVENTION

[0017] The sheet 2 is plastically deformed, before and/or in the welding zone and as shown in Fig. 1, by means of a squeeze roller 6 mounted on a support 7, so that any gap present between the sheets 1 and 2 is reduced and/or so that the maximum permitted width of gap stated above is not exceeded. The support 7 is pressed perpendicularly against the sheet 2, causing the deformed material to flow mainly in the direction of the arrow 8.

[0019] Fig. 2 shows a section through a further embodiment of the apparatus according to the invention. Here the metal sheets 1 and 2 for welding are of equal thickness. Instead of a single squeeze roller 6, two squeeze rollers 6 are used, each acting perpendicularly from above on one of

the sheets 1 and 2. The special feature of this arrangement is that both sheets 1 and 2 are deformed, so that smaller deformations are necessary to achieve the same effect. In other words, this embodiment could be used to reduce relatively large gaps between welding sheets 1 and 2 to within the maximum permissible width.

[0020] A further embodiment which is shown in Fig. 3 differs from that of Fig. 2 in particular in that the axes 10 of the supports 7 include an acute angle with the plane of the metal sheets 1 and 2. Sufficient room is thereby left at the joint 5 for the actual width of the gap to be detected for example by means of a detection device 14, so that the pressure force acting on the support 7 can be adjusted accordingly by a control arrangement.

[0021] A further feature of the embodiment shown in Fig. 3 is that the backing element 9, which was in one piece in Fig. 2, is now shown divided in two. As a result, the underside of the joint 5 also becomes freely accessible, which again facilitates the determination of the width of the gap by means of the detection device 14.

[0022] Fig. 4 shows a preferred embodiment of the apparatus according to the invention, in which a support 7 for a squeeze roller 6 is angled obliquely with respect to the plane formed by the metal sheet 1. The angled arrangement allows deformation of the sheet 1 to take place as close as possible to the joint 5. The sheet 2 is pressed against the backing element 9, and thus fixed in position, by a fixing unit 12 (also referred to as a "brake") which has at its lower end a fixing shoe 13 coming into contact with the sheet 2. This prevents the sheet 2 from being pushed back laterally should excessive deformation of the sheet 1 occur.

[0023] It can also be seen from Fig. 4 that the fixing unit 12 is in the form of a bar and is set at an oblique angle with respect to a plane formed by the sheet 2. Hence the joint 5 is again easily accessible for auxiliary devices 15.

[0024] The backing element 9 of the embodiment shown in Fig. 4 is formed as a roller with a rotational axis 11. The roller extends across the joint 5 and therefore supports both sheets 1 and 2. It would also be feasible to

provide separate backing elements 9 for the sheets 1 and 2 in a similar fashion to those of Fig. 3 but forming each backing element 9 as a roller with a rotational axis 11.

[0025] Although this invention has been shown and described with respect to the detailed embodiments thereof, it will be understood by those skilled in the art that various changes in form and detail thereof may be made without departing from the spirit and scope of the invention.

What is claimed is:

09031433, 030901